Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

PAPERS

IN

POLITE ARTS.

No. I.

MENSTRUUM FOR BITING-IN ON STEEL PLATES.

The LARGE GOLD MEDAL was this session presented to Mr. EDMUND TURRELL, Clarendon-street, Somers-town, for his MENSTRUUM FOR BITING-IN ON STEEL PLATE. The process was repeatedly performed before the committee with complete success: and the following communication on the subject has been received from Mr. Turrell.

THE demand that has taken place for engravings upon decarbonized steel plates, on account of their great durability when compared with copper plates, has caused many eminent artists to employ their talents upon that peculiar preparation of metal; and many beautiful specimens of line engraving have been produced, capable of yielding proofs or prints to an extent unknown before the invention and application of that peculiar preparation of steel, which was first, I believe, made known to the world by Mr. Perkins, who has made use of it very extensively in his bank-note manufactory in the United States of America, and more recently in London.

If the execution of a fine engraving upon such prepared or decarbonized steel had depended entirely upon the graving tool, the principal difficulty that presents itself would be the superior hardness of the metal, which of course would offer greater resistance to the action of the graver than copper; but as most or all the engravings of the present time are a mixture of etching and graving united, it was of course equally necessary for the artist to be able to etch and bite-in upon decarbonized steel, as well as to cut with the graving tool.

In order to form a just idea of the difficulties that occur in etching and biting-in upon steel plates, it will be necessary to state a few facts relative to etching upon copper.

The usual method is to cover the copper plate with a coat of varnish, commonly called etching ground; and when the lines that are necessary to represent the subject are cut through the varnish with a point or needle, a border or rim of soft wax is raised round the sides of the plate, and nitrous acid, sufficiently diluted with water, is poured upon the whole surface, and immediately a corrosion of the copper takes place in those parts or lines where the varnish has been removed or cut through. The action of the acid is at the same time rendered obvious to sight by the continual formation and disengagement of bubbles of nitrous gas on all the etched parts, thus indicating to the artist how the process is going on.

Various acids have been tried for this purpose, both singly and compounded in various proportions; but experience has proved that very pure nitrous acid is superior to any compound that has hitherto been produced, and I believe it is also superior to any other acid that can be used singly; for there is one requisite that is absolutely necessary and indispensable, namely, that whatever acid is used, it should not only have a powerful affinity for the copper, and by its chemical action corrode and deepen the etched lines, but it should also be capable of holding the oxide formed in perfect chemical solution, otherwise the lines would soon be choked up by a deposition of the oxide so formed: as the deposition increased, the oxide would press upon the edges of the etching varnish and loosen it, by which means a partial corrosion would take place under it, and shallow lines would be the consequence. The lines produced under such circumstances are also generally rough and uneven on their edges. The process just described is technically called *biting-in,* and such a production would be called a bad *biting.* On the contrary, when the oxide of copper formed during the process is immediately dissolved in the fluid that forms it, a fresh surface at the bottom of the line is continually offered to the acid to act upon, and then the corrosion produces the very best effect, that is to say, very deep lines, with beautiful clear and even edges.

When etching upon steel was first introduced, great difficulty was experienced in biting-in the etched plates, for, whatever acid was used, it invariably happened that the lines when corroded were exceedingly shallow and rough upon the edges, many times so much so as to cause serious disappointments and great loss to those engaged. Such, indeed, was the risk of failure, that several artists have refused to execute any thing on steel, on account of the difficulty of biting-in their etchings.

I believe I am correct when I state that Messrs. Perkins and Heath paid the late Mr. Lowry fifty pounds for the secret of a menstruum that would effect the biting on steel in a manner superior to that which they had previously practised. It is but justice to state that, previous to purchasing the before-named secret, their method was stated to all who applied to know it, and this consisted in using the worn-out acid that had been used for biting-in copper plates, which therefore was an acidulous nitrate of copper in the state of solution. But with this the results were very unsatisfactory, and almost always the lines were so much shallower than those produced on copper, that the proofs from the plates in that state were very grey and spiritless, for want of depth to hold the proper quantity of ink.

No person was more sensible of this defect than the late Mr. Charles Warren, and the method of biting-in upon prepared steel invented by him, and communicated to the public in the Transactions of the Society of Arts, &c. vol. 41, fully evince how warmly he entered into the investigation; and also, when he had attained a better method than was generally known, how liberally he presented it to his brother artists.

Had Mr. Warren stated in his communication that perfection was attained by his method, I should have conceived it an invidious task to dispute that point by offering to the Society's attention a method of biting-in etchings executed upon steel plates, which I feel confident has many advantages over any at present generally made known. But I am relieved from any such considerations by the recollection of his expressions to the committee, that he not only came forward to contribute what he had invented, but was also very desirous to elicit facts and information, by leading others to make experiments on the subject, as he had done. I therefore trust that those who respect his memory, and feel grateful for his communication, will consider that I am following his example; and although I may not have found out a faultless improvement, yet that much new light will be cast upon the subject, tending to elicit new facts, and thereby bring to speedy maturity a process that, in its present infant state, has many great and vexatious difficulties attached to it.

Shortly after Mr. Warren made his invention known to this Society, I was requested to execute some etchings on steel plates; but, previous to assenting, I thought it necessary to try how far the menstruum of Mr. Warren's invention would do for biting in the even tints produced by machine ruling, that being a kind of work more calculated to show the imperfection of bad biting than any other. And more particularly so when three lines are used to produce those aerial tints that are necessary to form the back grounds to portraits, and to many other subjects, which, if produced by the graving tool, would (upon steel) be enormously expensive.

Having prepared the menstruum according to the directions given, I certainly felt great difficulty in preventing a precipitation of the copper, which, filling the lines, continues to accumulate; and, by its pressure as it increases, removes the etching varnish partially from the sides of the lines, and thereby causes, in a great degree, the shallowness before complained of.

I have no doubt that on very small plates it may be possible to sweep the surface of the plate with such rapidity that this evil may in a great degree be prevented; but upon large plates, where they are covered with work, such an operation will be attended with great difficulty, and in many instances will be nearly impossible.

In biting-in on copper plates, the breadth of the etched line is in a great degree indicated by the size of the bubble of nitrous gas formed on the line; but where the lines are filled or covered with the precipitated copper, the difficulty of judging of the state of the biting is greatly increased.

These and other difficulties incited me to give the subject every attention in my power. The first indispensible requisite (as it appeared to me) was to determine what acid would most readily corrode the lines etched upon the steel plate; and, after trying a number, nitric acid, reduced to a proper strength by dilution, appeared to me the best adapted to this purpose, provided some means could be found of preventing it from depositing the oxide of iron after having taken it up.

Chemists well know that iron exists in two states of oxidation, the protoxid and the peroxid, and that each of these oxids will combine with acids forming two genera of ferruginous salts, the proto-salts and the per-salts. The proto-salts contain a larger proportion of oxid than the soluble per-salts; and being liable to pass into this latter state by long keeping, or in a short time when exposed to the air, their solutions will sooner or later become turbid, and will deposit peroxid of iron in a state scarcely at all soluble, except by being digested in hot acid, combined with some deoxidating substance.

For this reason it is that the action of nitric acid diluted with water will seldom give satisfactory results when employed for biting-in; for although at first it acts very well, the iron being brought merely to the state of protoxid, and dissolving freely in the acid, yet by exposure to the air, during the process of biting, it passes to the state of peroxid, a portion of which precipitates, and, falling into the lines of the etching, covers the surface of the steel at the bottom of these lines, and thereby impedes and renders irregular the action of the acid.

Knowing that calico-printers prefer making their solution of oxide of iron in pyroligneous acid, I conceived that, when in its pure state, this would be a very proper fluid to dilute the nitric acid with; because it would not only tend to reduce its action, but might prevent, or at least impede the precipitation of the oxide formed in the operation of biting. Although, however, something was gained by this addition, yet it did not appear to be so effectual upon repeated trials as to leave me completely satisfied. It then came into my mind that alcohol, and, still more, ether, have a very powerful deoxidating effect, as they are able to separate gold, in its pure metallic state, from its solution in aqua regia. I determined, therefore, upon adding to the mixture of pyroligneous and nitric acids a portion of alcohol, expecting that the nitrous ether resulting from this combination being presented in its nascent state to the nitrate of iron formed during the biting, would retain it in the state of proto-nitrate, and thus prevent any precipitation. I am happy to say I was not in the least disappointed; for with a menstruum thus formed or compounded of the three ingredients, namely, pyroligneous acid, alcohol, and nitric acid, I acquire the following advantages.

In the first place, it corrodes the steel with great facility, producing a beautiful, clear, and deep line; and upon a variety of plates the results were very uniform.

Secondly, it prevents the deposition of peroxid; as a proof of which I have kept some of the menstruum which had been employed for biting-in as long as six months, and could not discover any precipitation formed.

As a further proof of its power of holding the oxide formed in perfect solution, it will be distinctly seen that as soon as the corrosion takes place upon the steel plate the whole of the lines appear beautifully bright, and continue so until the biting-in is completed.

The proportions of the acids and alcohol are as follows:—take four parts, *by measure*, of the strongest pyroligneous acid, (chemically called acetic acid), and one part of alcohol, or highly-rectified spirits of wine; mix these together, and agitate them gently for about half a minute; then add one part of pure nitric acid; and when the whole are thoroughly mixed the menstruum is fit to be poured upon the etched steel plate.

When the menstruum is compounded in these proportions, very light tints will be sufficiently corroded in about one minute, or one minute and a half, and a considerable degree of colour will be produced in about a quarter of an hour. But the effect may be produced much quicker by the addition of more nitric acid, or it may be made to proceed much slower by omitting any convenient portion thereof.

The plate, when the mixture is poured off, should be instantly washed with a compound made by adding one part of alcohol to four parts of water; and the best material for stopping out any part that is sufficiently corroded is pure asphaltum dissolved in essential oil of turpentine, which of course must be of sufficient consistence to flow freely from a hair pencil. It may be necessary to inform those engravers that use the common Brunswick-black to stop out the bitings on copper plates, that it is a very improper article to use on steel plates; because, as the asphaltum and oil of turpentine of which it is principally composed do not render it sufficiently drying, these ingredients are digested with a small quantity of spirit of wine, which has a great tendency to unite with the biting menstruum above described, and thereby cause foul biting.

As I attach considerable importance to the purity of the ingredients of which my menstruum is composed, I beg leave to impress on my brother artists the necessity of strict attention to this circumstance: I have myself obtained the ingredients in a state entirely to my satisfaction from Mr. Desormeaux, 16, Chalton-street, Somerstown.

I am, Sir,
&c. &c. &c.
EDM. TURRELL,
46, Clarendon-street,
Somerstown.

A. Aikin, Esq.
Secretary, &c. &c.